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TAX REFORMS, DIGITALIZATION AND GOVERNMENT REVENUE IN NIGERIA

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ABSTRACT

In Nigeria, tax income collection has become a crucial policy goal for the government. The influence of tax reforms and digitalization on government income in Nigeria is therefore investigated. The study focuses on evaluating the distributional outcomes of tax revenue and digitalization on both federal and state government revenues. An ex post facto research design was adopted in the study and both descriptive and inferential analysis of the hypothesized relationships was performed. The relationships are analyzed using secondary data from 1996 to 2020 and a dynamic framework based on the autoregressive distributed lag (ARDL) approach to cointegration. The study confirmed that company income tax reforms improved federal government revenues but inhibited state government revenues (SGR) in Nigeria. It is therefore recommended that the conduct of fiscal reforms in Nigeria should evolve to become more of a bottom–top approach where all tiers of government are included.

Contribution/Originality: The study adds to the body of knowledge by demonstrating the existence of information asymmetry in revenue responses to tax reforms between the federal and state governments. This information asymmetry is a critical barrier between state and federal government revenue regimes in Nigeria.

1. INTRODUCTION

Globally, tax revenue mobilization in all its forms and ramifications has been identified as a pertinent issue affecting economic sustainability and growth (Olaoye, 2017). In Nigeria, it is said to be inconsistent with prevailing economic reality as Nigeria's tax laws do not conform to global best practices (Ndekwu, 2018). Tax reforms is a multifaceted and rapidly evolving phenomenon in taxation in any economy. The money that a government collects from taxes and non-tax sources to cover government spending is known as government income. Money, proper public investment, and social services; are required by governments to augment their spending. Nigeria's three tiers of government need more money to provide basic services to the country's citizens. There are various sources of revenue for governments, with taxes being one of the most important in both developing and developed countries (Pascual Sáez, Alvarez-García, & Castañeda, 2017).

One of these tax reform initiatives is the introduction of a direct sales tax that evolves throughout the value chain of production to consumption of taxable goods and services; this tax reform dynamism has placed these

economies in the frontier of what constitutes the overall best practices in modern tax revenue mobilization (Strawczynski & Zeira, 2017). The adoption of digital technologies has skyrocketed in African countries, such as South Africa, Kenya, Ghana, and Cape Verde, and the presence of Fintech firms, such as Uber, Amazon, Jumia, Spotify, and Ali Baba Express, in these countries could be said to justify the resolution to keep pace with digital transformation. The deployment of digital sophistication and stringent regulations have also been identified as key determinants of government capability to capture financial inflows through the internet domain and prevent capital flights that are not directly invested in the host countries. These funds are creatively repatriated to the domestic country with the view of evading tax where incomes, profits, and revenues are initially generated, derived and/or earned.

Section 30 of the Finance Act 2020, emphasizes the introduction of tax identification numbers as a prerequisite for opening a bank account that could mitigate tax avoidance and evasion, thereby bringing more taxpayers to the tax net (PWC, 2020). Section 36 of the Finance Act also repealed old section four on VAT. Under the new section, VAT increased from 5% to 7.5% with the aim of boosting revenue to settle the country's budget deficit. Extant literature underpinning the nexus between tax reforms and government revenue is limited in scope and diversity from the Nigerian perspective. Furthermore, there has been a perceived methodology gap proposing a model framework that depicts the exactness of tax reforms in quantitative measures in Nigeria's context, as extant literature is limited in statistical estimations and projections of the real economic reality of the impacts of tax reforms on government revenue; Finally, existing studies agree that oil revenue dominance has been a major contributor to the country's setbacks, whereas, contrary to popular belief, the current situation bedeviling the country's government revenue is inconsistent tax reforms that align with a loss of value for stakeholders, i.e., taxpayers. It is therefore against these backdrops that this study seeks to examine the nexus between digitalization, tax reforms and government revenue in Nigeria.

2. LITERATURE REVIEW

The concept of taxation has been consistent in many scholarly pieces of literature. As a widely discussed phenomenon, taxation cannot be regarded as undeserved. Although in a discipline such as management science, there is perceived difficulty in reaching a consensus about a universally acceptable definition of taxation, nevertheless, several attempts to gain insights into the concept have been consistent in a manner that is acceptable and compatible with economic reality. From a social science perspective, taxation is regarded as a legal framework adopted by the government to collect money and any other valuable resources from members of the public to provide social infrastructures.

Direct tax is imposed on the wealth and income of corporate entities and individuals, as the case may be under normal operating frameworks. It is not charged on expenditure and consumption of the same source but is payable by statutorily enabled economic agents, such as companies, people or associates of people characterized or of by physical identity and or entities with legal status. The presumptive taxation system is used to predict taxpayers' income based on information about variables not considered in the standard computation of taxable income (Adeleye, Osabuohien, Bowale, Matthew, & Oduntan, 2018). Joseph, Mahmoud, and Nuruddeen (2020) opined that direct tax is charged based on specific rates on the application for different assessment years as deemed fit by relevant tax authorities within the taxpayer's jurisdiction and incorporated into the budgetary frameworks of government.

The conceptual contrivance of indirect tax in Nigeria is made up of advertisement taxation, capital transactions, and excise and customs duties. The administrative subject of indirect tax is established by the Nigerian government in local and state jurisdictions to include tax proceeds from entertainment, sales, motor vehicle taxation, excise charges, stamp duties, and taxes from other commercially viable operations in the country.

The conceptual analogy of government revenue can be postulated alternatively. Although an increasing number of independent researchers have investigated the phenomenon, their perceived ideas vary across the board. Adams (2017), in an empirical examination of taxation, referred to government revenue as funds maintained by the government with the underlying objective of financing economic activities precipitated by the provision of necessities such as capital expenditures. Government revenue is usually generated from legal sources, such as borrowing, fees, fines, and or taxes (Areo, Gershon, & Osabuohien, 2020). Furthermore, revenue connotes the aggregate amount accrued to an entity from all sources of income regardless of the size, age, and corporate status at any time (Asnafi & Hamid, 2018).

More specifically, natural resources, particularly those used in the extractive industry, have been proved in many countries to boost revenue and economic success. Despite the positive experience with natural resource profits and economic development in industrialized countries, resource-rich emerging countries have found the opposite to be true. Natural resource earnings have proven to be more of a scourge than a blessing for most growing countries. Natural resource revenues are government revenues from the extractive industries (EI) sector. Rents, royalties, and taxes are among the sources of revenue. After all costs, have been deducted from revenue derived from the sale of EI resources, rents are the surplus value gained. The state is usually paid royalties as a percentage of the sale of EI resources. Profit taxes are the most common source of revenue, but they can also come from corporate income taxes, sector-specific 'special' taxes, or export taxes (Boadway & Keen, 2013).

Digitalization has become necessary for the proper creation and dissemination of information between taxpayers and the government. Digital infrastructures are modernized tools for creating and disseminating information between persons and entities. Some of the available digitalization tools commonly used today include hardware (such as modems, computers, and mobile phones), and software such as phone applications, computer programs and networks of integrated wireless service providers, such as the internet and other digital communication tools. These tools are used for processing, collecting, transmitting, and storing information to support operational capacity and effective organizational functions (Adewoye & Olaoye, 2014). Meanwhile, digitalization development provides the basis for harnessing historical, current, and projected information so that appropriately summarized forms of decisions are made about institutional quality (Adigbole & Olaoye, 2018). In the same vein, Obi (2018) conceptualized the development of digitalization from the premise that decision making is central to self-monitoring disturbances evident in a system, thereby determining a favorable course of action in getting the system under control.

Traditional tax procedures and methods have become ineffective as a result of digitalization, which has taken center stage in economic activities. As a result, the digital age has climbed to the top of all human endeavors. Today, information technology rules the world, resulting in the digital economy, e-commerce, and tax reforms that have changed the face of government tax administration and given corporate transactions remarkable speed (Obe, 2019). Taxation is the government's primary source of revenue, and tax administration is the central hub for keeping track of how much money is owed. The goal of information technology is to help tax officials do their jobs more efficiently while eliminating tax avoidance and evasion. In addition, information technology improves the speed and accuracy of tax data analysis. Taxation is a popular tool used by governments to impact social amenities and citizens' social lives (Dimitropoulou, Govind, & Turcan, 2018).

3. THEORETICAL FRAMEWORK AND MODEL SPECIFICATION

3.1. Theoretical Framework

3.1.1. Optimal Taxation Theory

The Optimal Taxation Theory analyzes how taxes can be stretched to produce the best social welfare effects (Hellerstein, 1997). The Ramsey rule and the Laffer curve model are two of the models included. Ramsey's rule: stated that the model generates the functions specified by Ramsey (1927); He proposed that the excess burden of

taxation could be reduced by making the tax rate inversely proportionate to the price elasticity of demand for electronic goods. This model implies that governments try to reduce the excess burden of tax to meet a specific revenue target. Ramsey's rule defines "optimal" taxes as the rate that reduces the extra burden of tax while still producing the requisite income from physical and intangible electronic transactions. The Laffer curve is a graph that depicts the relationship between two variables. Economist Arthur Laffer created the Laffer curve model of optimal taxation. The model implies that the government will try to generate as much revenue as feasible, regardless of the efficiency losses that taxes cause. The government's quest for more money can only be limited by constitutional limits and other legislation. The Laffer curve takes into account the inverse relationship between taxation and tangible and intangible electronic products, as well as the influence this relationship has on tax revenues. In electronic commerce transactions, the research shows that a higher tax rate is not always the most revenue-maximizing rate; in fact, a lower tax rate may produce more money than a higher tax rate (Effiong & Attah, 2017).

3.1.2. Expediency Theory

From the purview of taxation, it is pertinent that its proposition must align with practicality as a test required to understand what the core objectives of tax are and to what extent they can be achieved under normal economic working conditions and operations. However, the sole consideration for weighing the choice of tax propositions is vested with relevant tax authorities who determine the appropriate and correct tax to be paid. Otu and Theophilus (2013) are of the opinion that overall tax propositions ought to be required to pass a normality test posited as practicality, such that the sole consideration that underlies the choice of policies governing tax practices is embedded within the capacity of relevant agencies acting in the best interest of the government. However, the position of this theory is in concordance with the conceptual foundation of canons of taxation, which: are efficiency, economy, and effectiveness. The expediency theory on taxation provides the frameworks that set out the policies and guidelines by which relevant tax authorities effectively administer tax with the view to remedying social and economic ills, such as regional differences, income inequality, and unemployment (Afuberon & Okoye, 2018).

3.2. Model Specification

$$Y_i = \beta_{0i} + \beta_1 X_t + \beta_2 C_i \quad (1)$$

Where Y is the dependent variable; X is the explanatory variable, and C includes the battery of control variables. In furtherance of the earlier model, the following includes the explicit model for this study:

Model 1: Government Revenue and Tax Reforms

The model specification presents the relationship between government revenue (GREV) and tax reforms (Tax-REF).

$$GREV_i = \sigma_0 + \sigma_1 Tax\_REF_i + \sigma_2 Trade_i + \sigma_3 Inflation_i + \eta_i + \varepsilon_i \quad (2)$$

See Equation 1 for the definition of variables

Model 2: Government Revenue and Digitalization

Equation 3 presents the relationship between government revenue and digitalization.

$$GREV_i = \sigma_0 + \sigma_1 Digitalization_i + \eta_i + \varepsilon_i \quad (3)$$

See Equation 1 for the definition of variables.

Model 3: Government Revenue, Tax Reforms and Digitalization

Equation 4 presents the interaction between the three variables, namely tax reforms, digitalization and government revenue.

$$GREV_i = \sigma_0 + \sigma_1 Tax\_REF_i + \sigma_2 Digitalization_i + \sigma_3 Tax\_REF_i * \text{Digitalization}_i + \sigma_4 Trade_i + \sigma_5 Inflation_i + \eta_i + \varepsilon_i \quad (4)$$

See Equation 1 for the definition of variables.

β_0 = the intercept of the regression line, regarded as constant.

t---------- =1, 2, 3 ….41, indicating the period that will be used for this study (1995-2020)

β_{1-5}---------- = the coefficient or slope of the regression line or independent variables.

$\dot{e}_{it}$---------- = the error term which accounts for other possible factors that could affect the dependent variable not captured in the model (the stochastic error term is assumed to be identically and independently distributed).

4. DISCUSSION AND IMPLICATION

4.1. Discussion

The growth rates in the two tax components along with the growth rate in Total Federal Collected Revenue (TFCR) are shown in Figure 1. It can be seen that annual changes in TFCR between 1996 and 2002 were far more rapid than the annual changes in both corporate income tax (CIT)and VAT. For the tax revenues, company income taxes were more unstable than the other tax components, and there was a sharp decline in 2016 compared to the steadier transitions in VAT. There is therefore some evidence here that VAT provides a smoother revenue source than CIT and that planning with VAT (which is linked to consumption taxes) ensures more predictability in Nigeria.

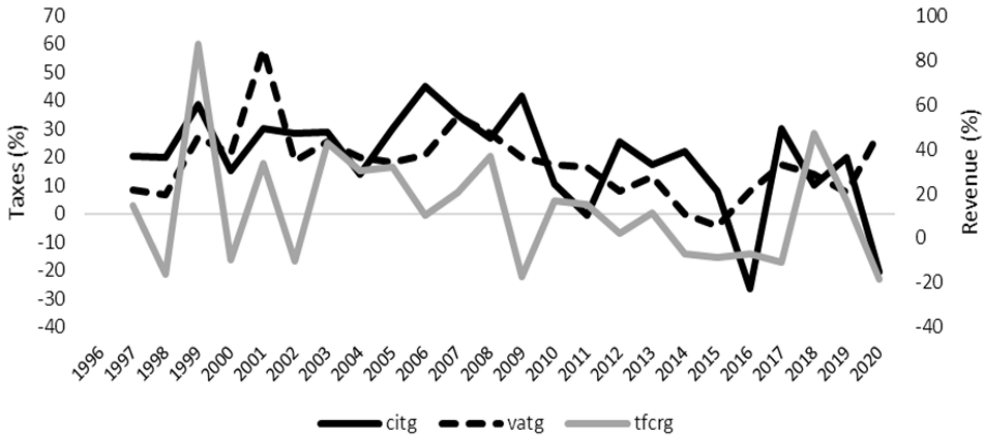

Figure 1. Growth rates in taxes and revenue.

Table 1. Descriptive statistics (revenue variables).

Variables	Mean	Max.	Min.	SD	Skew.	Kurt.	JB	Prob.
TFCRG	12.98	87.32	-18.42	25.60	0.96	3.94	4.57	0.10
FAR	59.27	92.74	27.24	18.68	-0.32	2.16	1.17	0.56
FGRR	45.49	76.30	31.33	13.68	1.09	2.98	4.99	0.08
IGRR	40.73	72.76	7.26	18.68	0.32	2.16	1.17	0.56
SGRR	33.16	53.48	16.64	9.39	-0.20	2.55	0.38	0.83
FAG	17.37	124.15	-53.14	39.19	1.26	5.21	11.30	0.00
FGRG	12.98	87.32	-18.42	25.60	0.96	3.94	4.57	0.10
IGRG	47.07	387.20	-84.37	114.67	1.77	5.89	20.92	0.00
SGRG	19.48	112.48	-22.14	28.05	1.46	6.19	18.70	0.00

Table 2 presents the descriptive statistics for the tax variables as well as other control indicators. The tax components are summarized in terms of their shares in total tax revenue (CITR and VATR), their shares in GDP (CITGDP and VATGDP) and their annual changes (CITG and VATG). The average CIT share of total revenue is 21.17%, while the average share of VAT of the total tax revenue is 20.47%. This indicates that CIT tax revenues just shade VAT as components of taxation in Nigeria, although the share of VAT may have risen strongly in recent years.

The ratio of CIT to GDP is 0.752 on average, while the ratio of VAT to GDP is 0.994. None of the tax components examined in this study has a contribution of up to 1% of the total GDP on average over the period, although both CIT and VAT have maximum values that are greater than 2%. This implies that the tax revenues are generally low in the country.

The Jacque-Bera (JB) statistic, which reveals the pattern of probability distribution of datasets, is another significant statistic computed in descriptive statistics. This pattern of probability distribution is critical for the estimating system used in the study. The J-B statistics for the majority of the variables (including the dependent variable) are negligible in both Tables 1 and 2, indicating that the hypothesis of non-normality of the data series may be rejected at the 5% level. The majority of the series are normally distributed, allowing the data to be estimated using a time series-based estimation framework, such as the one used in this study.

Table 2. Descriptive statistics (tax variables).

Variables	Mean	Max.	Min.	SD	Skew.	Kurt.	J-B	Prob.
CITR	21.17	33.91	9.77	7.32	0.08	1.85	1.40	0.50
VATR	20.47	37.83	11.06	6.83	0.69	2.86	1.98	0.37
CITGDP	0.752	2.250	0.210	0.417	1.489	6.059	28.852	0.00
VATGDP	0.994	2.110	0.250	0.455	0.824	3.255	2.895	0.23
CITG	19.56	44.95	-26.43	17.19	-1.14	4.24	6.71	0.03
VATG	18.03	58.10	-4.44	12.64	1.08	5.52	11.06	0.00
DIGIT	11.83	34.93	0.01	12.15	0.62	1.96	2.71	0.26
INFL	12.36	29.27	5.39	4.99	1.51	6.35	21.18	0.00
OPEN	37.64	53.28	20.72	9.12	-0.09	2.22	0.67	0.72
EXRT	161.51	316.70	76.28	75.45	1.09	2.90	4.93	0.08
DDYR	9.48	14.50	5.77	2.19	0.13	2.70	0.17	0.92
EXDYR	12.85	47.01	1.24	15.01	1.14	2.84	5.48	0.06

The descriptive statistics for the tax variables as well as other control indicators are also presented in Table 2. The tax components were summarized in terms of their shares in total tax revenue (CITR and VATR), their shares in GDP (CITGDP and VATGDP), and their annual changes (CITG and VATG). The average CIT share in total revenue is 21.17%, while the average share of VAT of the total tax revenue is 20.47%. This indicates that CIT tax revenues just shade VAT as components of taxation in Nigeria, although the share of VAT may have risen strongly in recent years.

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Figure 2; depicts the relationship between the two taxes included in the study. A straight line or direction positive relationship is observed in the chart, which shows that as one tax component rises, the other also increases. The plotted regression line indicates that the slope coefficient of 0.877 in the relationship. This is a very elastic relationship, indicating that every one percent rise in CIT will also lead to a 0.877% rise in VAT. This is a very strong interaction. which also suggests that tax revenue in Nigeria is linked. This may, however, present some risk to the tax system since a shock to one tax component may directly lead to a decline in the other.

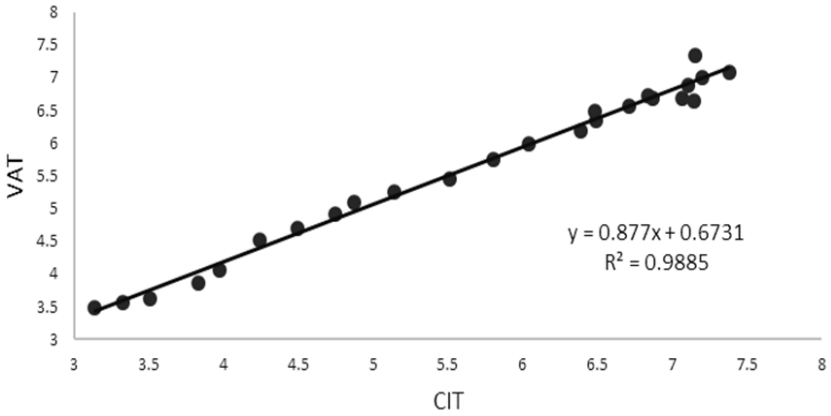

Figure 2. CIT and VAT.

In this study, the test for stationarity of the data series is performed using two different methods, namely; the Augumented Dickey-Fuller (ADF) and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) procedures. While the ADF test is an indirect process for testing for unit roots, the KPSS test is more direct in terms of the null hypothesis. Table 3 displays the results of the unit root testing. The ADF test statistics for each of the variables in levels (excluding are less than the 95% critical values, as can be seen from the results of the ADF tests presented in the first panel of the Table 3. The test statistic values for the series in first differences, on the other hand, are greater than the crucial values at the 5% significance level. As a result, those variables are non-stationary in terms of levels, but their first differences are stationary. This implies that the variables in the study are integrated of order one (or I[1]).

Table 3. Unit root test for variables.

Variables	ADF Test		KPSS		Order of Integration
	Levels	First Difference	Levels	First Difference	
TFCR	-2.066	-4.267	0.623	0.349	I(1)
FA	-1.491	-3.466	0.512	0.371	I(1)
FGR	-1.776	-6.303	0.669	0.339	I(1)
IRG	-1.678	-5.62	0.619	0.339	I(1)
SGR	-0.933	-3.919	0.632	0.378	I(1)
CIT	-2.586	-3.539	0.707	0.314	I(1)
VAT	-1.803	-3.053	0.711	0.293	I(1)
DIGIT	-4.062	-1.213	0.667	0.501	I(1)
INFL	-6.221	-4.831	0.106	0.208	I(1)
OPEN	-2.349	-5.772	0.530	0.500	I(1)
EXRT	-0.229	-3.144	0.627	0.243	I(1)
DDYR	-3.141	-4.170	0.185	0.125	I(1)
EXDYR	-3.551	-3.244	0.409	0.120	I(1)

The unit root test above suggests that most of the variables are I(1) while a few are I(0). This shows that determining the long-run relationship may require more than the standard test for common stochastic trends in data series (or cointegration test). As a result, the study uses an ARDL technique for cointegration, as suggested by Pesaran, Shin, and Smith (2001). This study uses the bounds testing approach for cointegration in this direction. Furthermore, the use of error correction algorithms (based on the ARDL method for cointegration) emphasizes the importance of cointegration tests. It's also important to figure out whether the model's explanatory components are forcing variables. As a result, the bounds test is performed, which includes all of the variables found on the left-hand side (Ahmed, Muzib, & Roy, 2013) If the equation with the dependent variable (Y) passes the cointegration test, strong cointegration is found. Table 4 shows the findings of the bounds test for cointegration, which are based on the crucial F-statistic values for the lower and upper bounds.

Table 4. Results of bounds test for cointegration

Equation (Dependent variables)	Level of Interaction	F-stat	I(0) Bound (5%)	I(1) Bound (5%)	Cointegration
Total Federally Collected Revenue	None	40.14	1.98	3.04	Yes
	Tax & Reform	15.23	1.98	3.04	Yes
	Tax & Digit	68.12	1.98	3.04	Yes
	Digit & Reform	5.96	1.98	3.04	Yes
State Government Revenue	None	33.36	1.98	3.04	Yes
	Tax & Reform	12.96	1.98	3.04	Yes
	Tax & Digit	18.77	1.98	3.04	Yes
	Digit & Reform	14.29	1.98	3.04	Yes
Federation Account	None	13.11	1.98	3.04	Yes
	Tax & Reform	7.03	1.98	3.04	Yes
	Tax & Digit	12.30	1.98	3.04	Yes
	Digit & Reform	9.77	1.98	3.04	Yes
Federal Government Revenue	None	13.11	1.98	3.04	Yes
	Tax & Reform	7.49	1.98	3.04	Yes
	Tax & Digit	31.08	1.98	3.04	Yes
	Digit & Reform	13.18	1.98	3.04	Yes
Independent Revenue of Government	None	37.83	1.98	3.04	Yes
	Tax & Reform	14.48	1.98	3.04	Yes
	Tax & Digit	41.47	1.98	3.04	Yes
	Digit & Reform	6.19	1.98	3.04	Yes

On the basis of their lag structures, cointegration-based studies are generally prone to fluctuations and instability. As a result, the lag selection test is used to establish the maximum lag that can provide optimum values for the coefficients in the ARDL estimation, assuming that the collection of variables in the study is expected to be cointegrated (see Table 4). The Akaike Information Criterion (AIC) and the Schwarz–Bayesian Criterion were used to determine the model's optimality in the lag selection (SC). The least values for the test coefficients are used to establish the optimal lag length. The results are displayed in Table 5, and they show that the first lag has the lowest value for each of the equations (based on all of the test results). Because each of the selection tests suggests the first lag as the ideal lag length, only the first lag is predicted to be preserved for the ARDL estimation. As a result, a one-period lag structure is chosen to reflect the structure that will assure more consistent coefficient estimates. The low optimal lag structure may be related to the small sample used in the study, as suggested by Ighodaro and Adegboye (2020).

Table 5. Lag length selection criteria.

No. of Lags	TFCR		SGR		FA		FGR		IRG	
	AIC	SC	AIC	SC	AIC	SC	AIC	SC	AIC	SC
0	3.88	4.18	3.12	1.34	2.42	1.04	3.28	0.55	3.12	0.34
1	-5.81*	-1.74*	-4.89*	-1.52*	-4.93*	-1.56	-5.41*	-1.72*	-4.27	-1.76*
2	-2.68	-0.83	-1.29	-0.41	-0.98	-1.02	-2.27	-0.71	-4.29*	-0.84

Note: * indicates selected lag.

In Table 6, the results of the short run estimates for the dynamic relationships for the linear relationships are presented. The cointegrated results were obtained based on the lag selection test performed earlier. The diagnostic

test in each of the equations is based on the adjusted R-squared values. In the estimates, the R-squared values are all very large, with the least being 0. 963.This shows that tax reforms, digitalization and the other variables explain over 98% of short-term variations in the revenue variables in Nigeria. This demonstrates that the models exhibit impressive predictive capacity. In terms of the individual performance of the explanatory variables, the results show that the coefficient of reform in CIT is significant at the 1% level in four of the five equations and each of the coefficients is positive. For the VAT reform variable, the coefficient is significant in all the equations, although the sign is negative for state government revenues and federation accounts. These two outcomes highlight the importance of the role of reforms on government revenues.

The coefficient of CIT reform only failed the significance test at the 5% level, which shows that reforming the CIT did not have any significant impact on state government revenues in Nigeria in the short run. On the other hand, the CIT reform coefficient was significant and positive for all the federal government-related revenues. It is also seen that the coefficient of VAT reform had a significant negative impact on state government revenue as well as federal government revenue in the short run. The negative impact on state government revenue also indicates that VAT reforms generated a negative structural break (downward shift) in the state government revenue curve in Nigeria. The same VAT reform, however, had a significant positive impact on three of the federal government-related revenues in the short run.

Table 6. Estimates for linear relationships.

Variables	TFCR	SGR	FA	FGR	IRG
ΔCIT_reform	0.486** (0.02)	0.004 (0.02)	0.356** (0.03)	0.147** (0.04)	2.403** (0.07)
ΔVAT_reform	0.357** (0.02)	-0.357* (0.01)	-0.274** (0.02)	0.602** (0.07)	0.869** (0.04)
ΔCIT	0.735** (0.02)	-0.015 (0.03)	0.261** (0.04)		
ΔVAT	1.891** (0.02)		0.370** (0.04)	1.106** (0.09)	3.979** (0.10)
ΔOPEN	1.334** (0.02)	0.087* (0.02)	0.839** (0.03)		2.608** (0.05)
ΔDDYR	-1.476** (0.02)	-0.326** (0.05)		-0.244* (0.10)	-3.879** (0.16)
ΔDIGIT	0.357** (0.02)	-0.035* (0.01)	1.451** (0.03)	0.436** (0.04)	-0.917** (0.04)
ΔEXDYR	0.283** (0.02)	0.160** (0.01)			0.370** (0.02)
ΔLEXRT	-0.187* (0.02)		-2.543** (0.05)		1.771** (0.15)
Δ GFCF	-0.575** (0.02)	0.039 (0.03)	0.955** (0.01)	0.253* (0.08)	0.138 (0.09)
ECM_{t-1}	-1.099** (0.02)	-0.937** (0.02)	-0.476** (0.06)	-1.158** (0.07)	-1.514** (0.03)
Adj. R-sq.	0.998	0.963	0.971	0.974	0.986

Note: * and ** indicate significance at the 5% and 1% levels, respectively.

The results for the long-run linear relationships are presented in Table 7. Note that the long-run results obtained from the ARDL procedure show the effects of the independent variables on the dependent variables after all short-term adjustments have been made. The R-squared results are not included since the estimates are asymptotic. In the estimates, the coefficient of CIT reform is significant for the TFCR, SGR, FGR, and IRG equations. Thus, it is seen that although the CIT reform did not have a significant impact on state government revenues in the short run, the long-run impact was highly significant. In the long run, the CIT reform is estimated to have resulted in a 0.602% increase in total federally collected revenue and a 0.407% increase in state government revenue. In Nigeria, it appears that state administrations take some time to see favorable results from CIT changes. For the TFCR and the other two federal-related revenues, the VAT reform coefficient is substantial.

However, the impact on SGR is negative and significant at the 1% level. Essentially, even after all adjustments have settled, the VAT reforms actually inhibited state governments' revenue in Nigeria. It is seen that the share of negative impact of the VAT reform on SGR was almost as large as the scale of the positive impact on TFCR.

Table 7. Results for tax reforms, digitalization and government revenue.

Variables	TFCR	SGR	FA	FGR	IRG
CIT reform	0.602* (0.09)	0.407* (0.16)	0.052 (0.27)	0.329* (0.13)	2.851** (0.20)
VAT reform	0.569* (0.06)	-0.550** (0.07)	0.155 (0.21)	0.310* (0.14)	0.945** (0.14)
CIT	1.291* (0.16)	-0.118 (0.17)	4.866** (0.79)	1.288* (0.44)	0.924* (0.21)
VAT	-0.456 (0.18)	0.472* (0.14)	-7.038** (1.09)	-0.745 (0.46)	0.397 (0.23)
DIGIT	0.216* (0.07)	0.360** (0.06)	1.760** (0.22)	0.082 (0.09)	-0.492 (0.11)
OPEN	1.102** (0.09)	0.457* (0.11)	2.728** (0.41)	0.556* (0.18)	1.833** (0.17)
DDYR	-0.774 (0.28)	0.888* (0.30)	3.228* (0.86)	-0.664 (0.52)	-1.364* (0.48)
EXDYR	0.454** (0.03)	0.103 (0.04)	0.298** (0.09)	0.162 (0.08)	0.374* (0.10)
EXRT	-1.512* (0.16)	-0.730** (0.13)	-3.173** (0.37)	-0.568* (0.19)	-0.043 (0.24)
GFCF	0.075* (0.12)	-0.323* (0.11)	-0.729* (0.25)	-0.060 (0.17)	0.789* (0.24)
C	6.540** (0.61)	5.899** (0.60)	18.043** (1.64)	5.875** (1.05)	-9.092** (1.42)

Note: * and ** indicate significance at the 5% and 1% levels, respectively.

In order to determine the exert dimension of the effects of reforms on government revenues, the slope coefficients of the dummy effects are estimated along with the initial impact of the tax components. This reflects the estimation of non-linear relationships for the equations using the interaction terms. The first interaction with short-run results, reported in Table 8, is the interaction between tax components and the reforms. The goal of this interaction is to observe the influence of tax reforms on the impact of the two taxes on government revenues in Nigeria. The coefficient of the interaction between CIT reform only passed the significance test for the TFCR and IRG equations.

The two coefficients are significant, which suggests that CIT reforms increased the short-run contribution of CIT to federal government revenues in Nigeria. The effect of the CIT reform on short-run behavior of state government revenue is not significant, suggesting that reforms did not immediately change the dimension of CIT contribution to state government revenue in any significant way.

For the VAT interactions, the results show that the coefficient of the interaction between VAT and its reform is significant and positive for the federal-related revenues but it is negative for the state government revenue in the short run.

Thus, there is evidence that reforms in the tax system (CIT and VAT) did not have any meaningful influence on the contribution of CIT to state government revenues in Nigeria. The short-run effects are, however, very clear in terms of federal government revenue in Nigeria. The coefficient of digitalization is positive for the federal revenues, but negative for the state government revenues. This, again, suggests that digital innovations do not immediately promote state revenues, even though the effect on the federal revenues are positive and very clear.

Table 8. Short-run interaction results for tax components and tax reforms.

Variables	TFCR	SGR	FA	FGR	IRG
ΔCIT	0.647** (0.04)	-0.072 (0.05)	0.713** (0.09)	1.399** (0.07)	0.283 (0.16)
ΔCIT*REF	0.155** (0.01)	-0.007 (0.01)	0.020 (0.01)	-0.014 (0.01)	0.582** (0.02)
ΔVAT	2.599** (0.09)		0.846** (0.10)	0.032 (0.07)	3.605** (0.21)
ΔVAT*REF	0.060** (0.00)	-0.051** (0.00)	0.012 (0.01)	0.066** (0.01)	0.084** (0.01)
ΔDIGIT	1.168** (0.04)	-0.114* (0.03)	1.393** (0.06)		
ΔINFL	0.002 (0.01)			0.526** (0.03)	-0.289** (0.06)
ΔEXRT	-0.276* (0.07)	-0.237* (0.09)	-1.468** (0.16)	-1.922** (0.10)	
ΔOPEN	1.531** (0.03)	0.178** (0.04)	1.130** (0.07)	0.684** (0.04)	2.329** (0.10)
ΔEXDYR	0.031 (0.02)	0.179** (0.02)	0.194** (0.03)	0.452** (0.02)	0.256** (0.04)
ΔDDYR		-0.875** (0.09)	0.090 (0.16)	-0.748** (010)	
ECM_{t-1}	-1.334** (0.05)	-0.654** (0.03)	-0.885** (0.04)	-0.173** (0.01)	-1.540** (0.01)
Adj. R-sq.	0.993	0.977	0.971	0.974	0.986

Note: * and ** indicate significance at the 5% and 1% levels, respectively.

Table 9. Long-run interaction results for tax components and tax reforms.

Variables	TFCR	SGR	FA	FDR	IRG
CIT	1.087* (0.28)	-0.493 (0.60)	3.150* (1.01)	19.31 (67.2)	-0.353 (0.71)
CIT*REF	0.085* (0.02)	0.108 (0.10)	-0.077 (0.08)	-0.352 (1.64)	0.607** (0.05)
VAT	-0.533 (0.34)	0.701* (0.18)	-3.427 (1.24)	-24.49 (87.9)	0.762 (0.86)
VAT*REF	0.098** (0.02)	-0.104* (0.05)	0.094 (0.06)	0.745 (2.59)	0.092* (0.03)
DIGIT	0.251 (0.08)	0.495* (0.18)	0.997* (0.20)	2.157 (7.64)	-0.354* (0.13)
INFL	-0.196 (0.10)	0.010 (0.10)	0.148 (0.18)	5.630 (20.3)	-0.376 (0.23)
EXRT	-1.204** (0.18)	-0.959* (0.28)	-3.008** (0.39)	-2.073 (5.56)	0.362 (0.30)
OPEN	1.065** (0.14)	0.567 (0.30)	1.593 (0.54)	5.033 (16.3)	1.755** (0.32)
EXDYR	0.252* (0.05)	0.110 (0.09)	0.381* (0.13)	1.413 (4.46)	0.418** (0.07)
DDYR	-0.378 (0.30)	1.213 (0.90)	0.518 (0.77)	-8.483 (28.5)	-0.864 (0.50)
C	6.681** (0.90)	5.533* (1.32)	14.88* (1.91)	27.28 (78.1)	-4.041* (1.52)

Note: * and ** indicate significance at the 5% and 1% levels, respectively.

The result for the long-run relationship based on the interactions between tax components and the respective reforms is presented in Table 9. The long-run results show that CIT reform has significant positive impact on TFCR and IRG given their positive coefficients. Thus, there is evidence that a CIT reform not only directly improved federal revenues in Nigeria, it also indirectly impacted federal revenues by stimulating the CIT component of the tax system. The overall coefficient (when the shift in the slope due to reform is considered) is 1.172, which is highly elastic. This result shows that the reform of CIT led to a long-run increase in federally

collected revenues by 1.17 percentage points (over a hundred percent increase). The result for the interaction of VAT with its reform shows that, while the reform had significant positive impact on federally collected revenue, the impact on state revenue is negative in the long run. The results indicate that the current VAT system of administration has led to decreases in the contribution of VAT to state government revenues the VAT coefficient in the SGR equation (0.701) is significant at the 5% level. When the VAT reform is taken into account the coefficient of the impact of VAT on SGR drops to 0.597. The coefficient of digitalization is positive and significant for SGR and FA equations, indicating that digitalization is good for promoting long-run revenue expansions for state governments in Nigeria. Again, the exchange rate coefficient is predominantly negative and shows that depreciation harms revenues in the long run. In Table 10, the results of the short-run estimates for the dynamic relationships in terms of the interaction between digitalization and tax components are reported. The cointegrated results were obtained based on the lag selection test performed earlier. The diagnostic test in each of the equations based on the adjusted R-squared values reveals that the model has high explanatory capability. This is due to the high adjusted R-squared values for each of the equations (at least 95%). This outcome provides a background to evaluate the estimated coefficients in the results. In the results, the role of each variable on the revenue stream is determined by observing the individual coefficients of the explanatory variables. The results show that the coefficient of reform in the interaction between CIT and digitalization is positive in almost all the equations (including that of state government revenue). This shows that digitalization has led to an increase in the contribution of CIT to revenues of government in the short run. This result suggests that although digitalization does not immediately have direct impact on state government revenues, it has an indirect impact. On the other hand, the immediate impact of digitalization on federal revenues is mostly positive, both directly and indirectly. This result shows that, in terms of government revenues, the main impact of digitalization directly influences the dimension of the contribution of CIT revenue to the overall revenue of the Nigerian government, especially in the short run.

Table 10. Short-run for results interaction between tax and digitalization

Variables	TFCR	SGR	FA	FDR	IRG
ΔCIT	-1.687** (0.05)	-0.229** (0.05)	-1.453** (0.18)	1.778** (0.05)	-3.874** (0.22)
ΔCIT*DIGIT	0.368** (0.01)	0.167** (0.01)	0.182** (0.05)	-0.251** (0.01)	0.740** (0.06)
ΔVAT	2.269** (0.04)	1.205** (0.05)	-0.707** (0.06)	-0.610** (0.04)	3.322** (0.20)
ΔVAT*DIGIT	-0.566** (0.01)				-0.838** (0.06)
ΔDIGIT	2.218** (0.04)	-0.677** (0.06)	3.021** (0.15)	1.454** (0.04)	2.506** (0.13)
ΔINFL				0.445** (0.01)	0.429** (0.04)
ΔEXRT	-0.639** (0.04)			-1.771** (0.05)	
ΔOPEN	0.809** (0.01)	0.013 (0.01)		0.707** (0.02)	1.323** (0.07)
ΔEXDYR	0.191** (0.01)	0.232** (0.03)		0.626** (0.01)	

Note: * and ** indicate significance at the 5% and 1% levels, respectively.

The coefficient of the interaction between VAT and digitalization is negative for TFCR and IRG and not observable for the other equations. This result shows that digitalization inhibits the contribution of VAT to revenues at the federal level in the short run. This is the first negative impact of the tax or digitalization coefficient on TFCR in the study. This result provides evidence that in terms of VAT, digitalisation tends to inhibit the VAT contribution to the total government revenue in Nigeria. It therefore appears that digitalization is more compatible with CIT than with VAT in the short run. High levels of digitalization may have led to greater difficulty of VAT

realizations in Nigeria. The coefficient of digitalization has a positive short-run effect on the federal revenues but negative short-run effect on state revenues.

The final sets of estimations involve interactions between digitalization and tax reforms in Nigeria. The short-run estimates are presented in Table 11. In the estimates, the adjusted R-squared values are high for each equation and indicate the strong explanatory power of the models. For the respective variables, the results for interaction between digitalization and CIT reforms show that the coefficient is positive for TFCR, FA, and FGR in the short run. This shows that the reform in VAT favors revenues of government during periods of improved digitalization in the economy, especially in the short run. The results also show that the CIT reforms are in line with expansion of the digital economy in Nigeria, with the reforms appearing to aid the tax compliance conditions of the digital economy in the short run.

For the interaction between VAT reform and digitalization, the coefficient is negative for the two federal revenue components. This shows that, like the case of interaction between VAT and digitalization, the reforms in VAT tend to limit the contribution of the digital economy to revenues in Nigeria, especially in the short run. The coefficient of digitalization in the short run is positive for most of the estimates, which shows that more digitalisation leads to better revenues, especially when tax reforms are taken into account.

The coefficients of the error correction factors have the predicted negative signs in all five short-run estimations, and they are all significant at the 1% level. The negative sign indicates that any revenue departure from its long-term trend or equilibrium will be rectified over time. Based on population and other associated indicators, this confirms the presence of long-run economic stability. For SGR and FA, the coefficients of the ECM terms are more than 1.0 (in absolute terms), implying that the changes to long-run equilibrium for these revenue streams are indirect.

Table 11. Short-run estimates for results with interaction between digitalization and tax reforms.

Variables	TFCR	SGR	FA	FGR	IRG
ΔCIT_REF*DIGIT	0.087** (0.01)	-0.006 (0.16)	0.015* (0.00)	0.045** (0.00)	-0.096** (0.02)
ΔVAT_REF*DIGIT	-0.060** (0.01)			-0.021** (0.00)	
ΔCIT			0.813** (0.08)	0.789** (0.04)	-1.746** (0.34)
ΔVAT	-0.721* (0.17)	1.355** (0.03)	0.706** (0.10)	-0.423** (0.05)	
ΔDIGIT	0.151 (0.06)	0.282** (0.01)	1.083** (0.05)	0.529** (0.02)	-0.801** (0.19)
ΔINFL	0.382** (0.05)	-0.041* (0.01)	0.090 (0.03)	0.547** (0.02)	0.695** (0.12)
ΔEXRT	-3.484** (0.27)	-0.054* (0.02)	-1.311** (0.15)	-2.343** (0.08)	-5.109** (0.74)
ΔOPEN			0.987** (0.06)	0.996** (0.03)	
ΔEXDYR	0.956** (0.06)		0.236** (0.02)	0.690** (0.02)	
ΔDDYR	-0.724* (0.20)	-0.504** (0.03)	-0.364 (0.14)	-0.863** (0.07)	-0.217** (0.57)
ECM_{t-1}	-0.164** (0.01)	-1.121** (0.08)	-1.113** (0.05)	-0.702** (0.02)	-0.872** (0.06)
Adj. R-sq.	0.946	0.979	0.976	0.988	0.906

Note: * and ** indicate significance at the 5% and 1% levels, respectively.

Table 12. Long-run estimates for results with interaction between tax and digitalization.

Variables	TFCR	SGR	FA	FGR	IRG
CIT	-0.301 (0.17)	0.407* (0.16)	0.144 (0.60)	6.022 (3.69)	0.100 (0.63)
CIT*DIGIT	-0.161 (0.06)	-0.550** (0.08)	-0.233 (0.18)	0.417 (0.31)	-0.968** (0.17)
VAT	0.041 (0.25)	-0.118 (0.17)	0.468 (0.53)	-10.88 (7.07)	-2.021** (0.74)
VAT*DIGIT	0.309* (0.06)	0.472* (0.14)	0.080 (0.19)	0.015 (0.16)	1.552** (0.17)
DIGIT	0.091 (0.05)	0.457* (0.11)	1.192** (0.19)	1.233* (0.06)	-1.613** (0.19)
INFL	-0.069 (0.03)	0.888* (0.30)	-0.218 (0.12)	2.708 (1.88)	0.595* (0.21)
EXRT	-1.418** (0.19)	0.360** (0.06)	-1.554** (0.37)	-4.361 (2.26)	-0.542 (0.51)
OPEN	0.734* (0.14)	0.103 (0.05)	0.091 (0.23)	3.566 (2.01)	1.375** (0.29)
EXDYR	0.221* (0.04)	-0.730** (0.13)	0.068 (0.10)	1.210 (0.69)	0.222 (0.13)
DDYR	-0.023 (0.12)	-0.323* (0.11)	0.736 (0.41)	-0.391 (0.43)	-1.856** (0.39)
Constant	12.657** (0.74)	5.899** (0.60)	11.095** (1.88)	30.85 (14.9)	15.13** (2.77)

Note: * and ** indicate significance at the 5% and 1% levels, respectively.

The long-run estimates are presented in Table 12 In the results the coefficient of the interaction between CIT reform and digitalization is significantly positive for two of the federal revenues and negative for the state government revenue. For the federal government revenue, the result shows that the reform in CIT tends to favor the digital economy in terms of improvement in the tax component. Thus, there is evidence from the long-run estimates that CIT reforms may actually be compliant with the modern digital economy. The result for the state government revenue, however, reveals that the CIT reform interaction with digitalization has a negative coefficient indicating a negative impact of this interaction with state revenues. For the interaction between VAT reform and digitalization the result shows that the coefficient is negative for the IRG and fails the test for the other equations.

This result is similar to the short-run estimates, and suggests that, like the case of interaction between VAT and digitalization the reforms in VAT tend to limit the contribution of the digital economy to revenues in Nigeria, especially in the short run. The coefficient of digitalization is positive in the long run result, indicating that digitalization could be useful for all streams of revenue in Nigeria. As stated above, such revenue expansion may not necessarily be as a result of tax expansion.

5. CONCLUSION AND RECOMMENDATIONS

The results from the empirical analysis of the study provide effective grounds for suggesting relevant recommendations in different dimensions. First, the study has shown that tax reforms may generate differing outcomes for federal and state government revenues in Nigeria. This is a critical outcome for policy reforms in Nigeria. The results indicate that since tax reforms are mostly generated and applied by the federal government, the impacts of reforms are felt by federal revenue outcomes than those of the state. This calls for a re-calibration of the fiscal reform in Nigeria. In essence, fiscal reform processes should be more of a bottom-top approach where all tiers of government are included so that the sub-national governments can make arrangements to quickly obtain benefits from reforms. The case where reforms are passed down from the center to the states will always generate information asymmetry and further increase constraints on tax policy for the states.

Second, given the weak, and sometimes negative, direct and indirect effects of digitalization on state government revenues shown in the results, state governments need to enhance their participation in the digital economy in

Nigeria. The reason for the undesirable impacts of digitalization on the tax revenue implications of state governments have been linked to shortages of skills, equipment and physical infrastructure to assist them in fully engaging with the digital economy.

Both state and federal governments need to evolve systems that are useful in addressing the emerging and persistent challenges in terms of cyber security risk management as well as data protection. With this fast-adjusting digital economy, governments' policy and regulatory guidance are critically required to develop a useful background for maximizing the tax system in Nigeria. In essence, the current level and rate of digital transformation in Nigeria calls for effective cooperation between the two governments (state and federal) in order to enhance tax administration and support effective and efficient digitalization of the tax system as well as optimize revenues from a highly digitized system in the country.

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